Object-to-Relational Mapping & Object-to-XML Mapping

NCICB Software Development Processes
Facilitating Systems Interoperability

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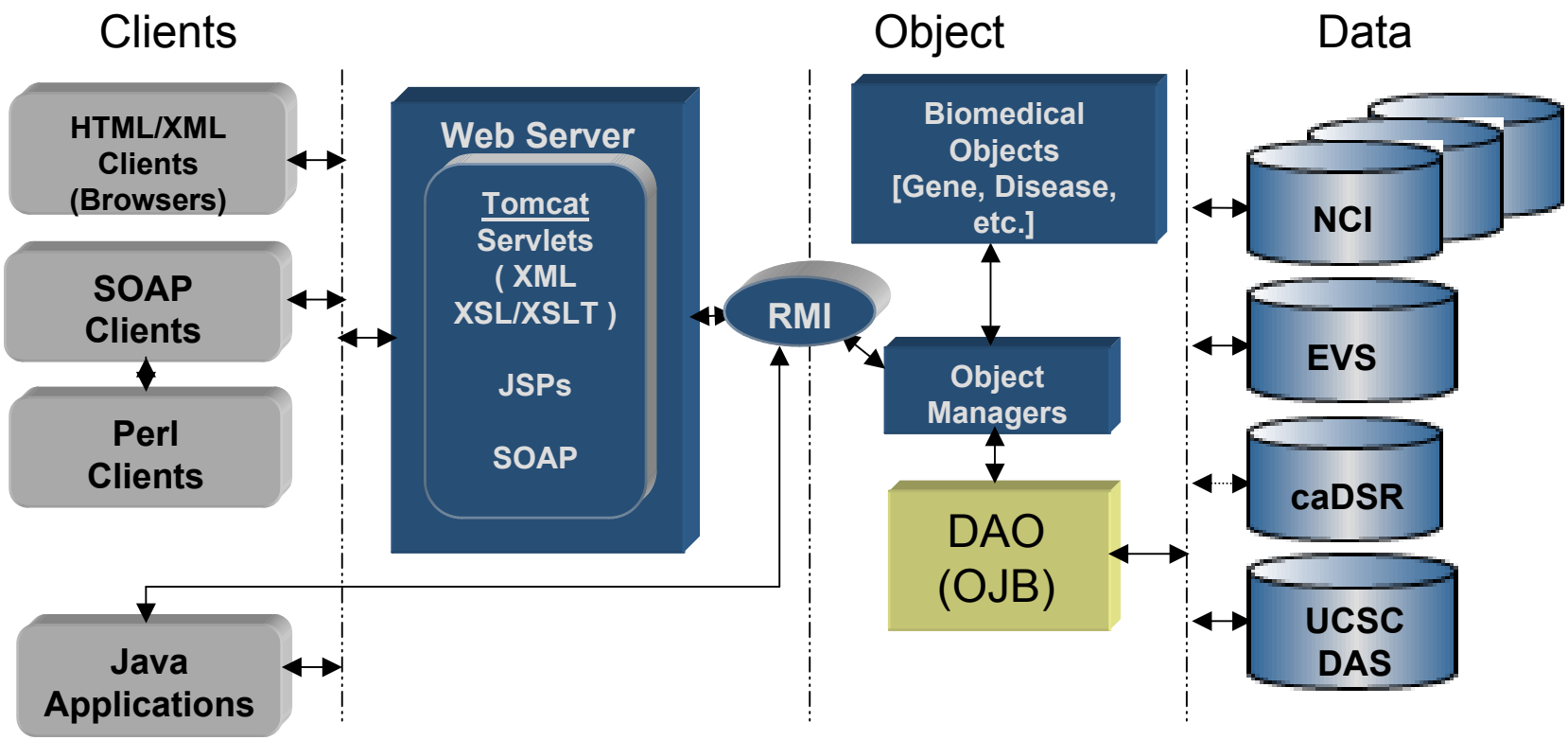
Agenda

- Introduction
- Benefits of Object Rational Mapping (ORM)
- Object / Relational Differences
- Open Source Tools for Object-to-Relational Mapping
  - Using OJB
  - Using Hibernate
- Object-to-XML Mapping
  - Available Tools
- Q&A

Introduction

- Object-to-relational mapping decouples the domain objects from the data stores



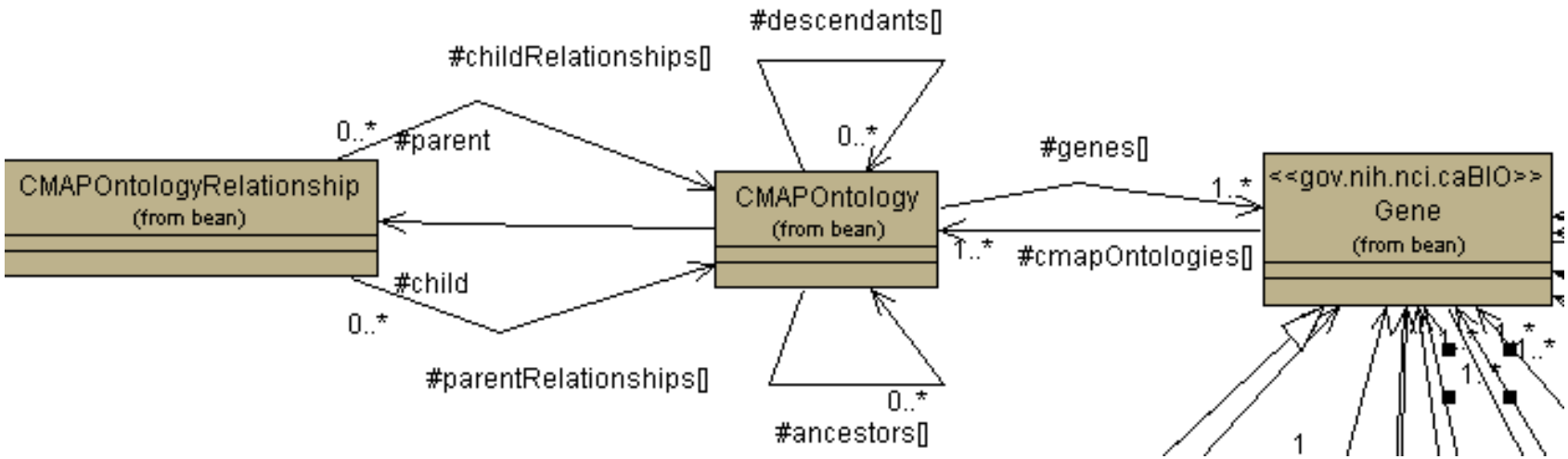
Benefits of Object Relational Mapping

- Exposes data as objects
- Facilitates the creation, restoration, persistence, and deletion of objects in a relational database
- Provides model driven data access
- Permits transformation of data to different formats – XML
- Allows for the development of code regardless of the data source - Oracle, SQL Server, DB2, MySQL, etc.

Object / Relational Differences

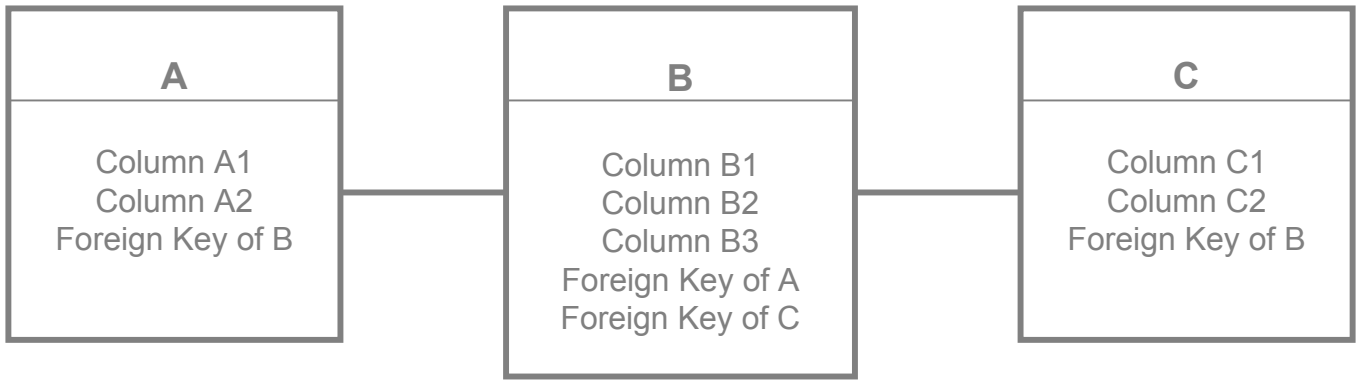
- Object-oriented paradigm is based on engineering principles
- Relational paradigm is based on mathematical principles
- Objects are traversed through relationships
- Relational paradigm joins data from tables

Object-Oriented World



- One object is related to the other by inheritance, with different role name/type and different cardinality

Relational World



- Table A is related to Table B and Table B is related to Table C by a constraint (foreign key column)

Object-to-Relational Mapping

- The class is mapped to the table using OR mapping metadata
- The data type in the object is mapped to the data type in the table

JDBC Type	Java Type
CHAR	String
VARCHAR	String
LONGVARCHAR	String
NUMERIC	java.math.BigDecimal
DECIMAL	java.math.BigDecimal
BIT	boolean
BOOLEAN	boolean
TINYINT	byte
SMALLINT	short
INTEGER	int
BIGINT	long
REAL	float
FLOAT	double
DOUBLE	double

Open Source Tools for Object-to-Relational Mapping

- Hibernate(http://hibernate.org)
- ObJectRelationalBridge (OJB) (http://db.apache.org/ojb/)
- SimpleORM (http://www.simpleorm.org/)
- Speedo (http://speedo.objectweb.org/index.html)
- Torque (http://db.apache.org/torque/)
- XORM (http://xorm.sourceforge.net/)
- Others

Tool Features

- Pluggable Services
- Multiplicity Mapping
- Easy Use of Multiple Databases
- Distributed Lock Management
- Reusability – Connection Pool / Cache
- Support for Polymorphism and Collection
- Test Cases / Log

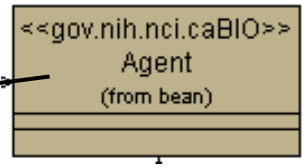
Using OJB

- Configuration
  - The object and its attributes are mapped to corresponding tables and fields in the database

repository_map.xml - Notepad

File Edit Format Help

```
<!--================== Agent ====================-->
<class-descriptor
   class="gov.nih.nci.caBIO.bean.Agent"
   table="AGENT">

 <field-descriptor
   name="id"
   column="AGENT_ID"
   jdbc-type="BIGINT"
   primarykey="true"/>

 <field-descriptor
   name="nSCNumber"
   column="NSC_NUMBER"
   jdbc-type="BIGINT"/>

 <field-descriptor
   name="name"
   column="AGENT_NAME"
   jdbc-type="VARCHAR"/>

 <field-descriptor
   name="comment"
   column="AGENT_COMMENT"
   jdbc-type="VARCHAR"/>

 <field-descriptor
   name="evsId"
   column="EVS_ID"
   jdbc-type="VARCHAR"/>

 <field-descriptor
   name="isCMAPAgent"
   column="CMAP_AGENT"
   jdbc-type="BIGINT"
conversion="gov.nih.nci.common.persistence.conversions.BN2BoolConv"/>
```



Using Hibernate

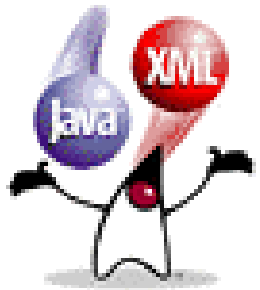
Hibernate_map.hbm.xml - Notepad

File Edit Format Help

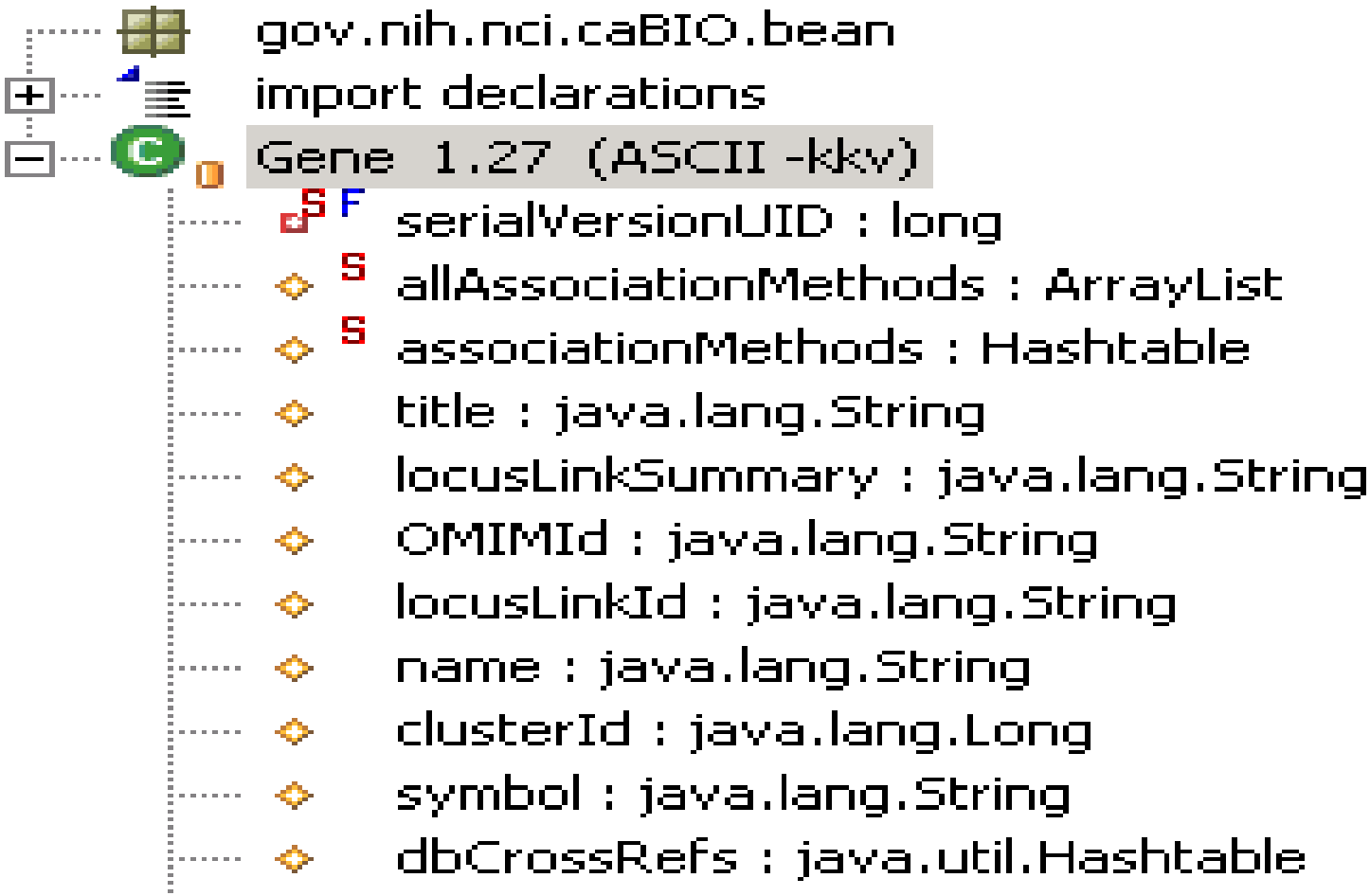
```
<hibernate-mapping>

  <class name="gov.nih.nci.caBIO.bean.Gene" table="GENE">

    <meta attribute="class-description">
      Gene objects are the effective portal to most of the
      genomic information provided by the caBIO data.
    </meta>

    <id name="id" type="int" column="GENE_ID">
      <meta attribute="scope-set">protected</meta>
      <generator class="native"/>
    </id>

    <property
      name="name"
      column="GENE_SYMBOL"
      type="string"/>

   <property
      name="locusLinkId"
      column="LOCUS_LINK_ID"
      type="string"/>
```

Object-to-XML Mapping

- Provides a convenient way to bind an XML schema to a representation in Java code
- Incorporates XML data and processing functions in Java based applications without having to know much about XML itself
- Allows for the transformation of data contained in a Java object model into/from an XML document
- Supports marshalling / unmarshalling



caBIO Gene Object



caBIO Gene Object Mapped to XML


```
- <gov.nih.nci.caBIO.bean.Gene xmlns="" id="2"
    xmlns:xlink="http://www.w3.org/1999/xlink/">
    <title>N-acetyltransferase 2 (arylamine N-acetyltransferase)
      </title>
    <OMIMId>243400</OMIMId>
    <locusLinkId>10</locusLinkId>
    <name>NAT2</name>
    <id>2</id>
    <symbol>NAT2</symbol>
    <clusterId>2</clusterId>
    <Organ xlink:href="http://cabio.nci.nih.gov:80/servlet/GetXML?
      query=Organ&crit_expressedGenes_id=2" />
    <Target xlink:href="http://cabio.nci.nih.gov:80/servlet/GetXML?
      query=Target&crit_genes_id=2" />
```

Available Tools

- JAXB (http://java.sun.com/xml/jaxb/)
  - JSR 31/222 Implementation
- Castor (http://www.castor.org/)
- DOM4J (http://dom4j.org)
- JaxMe (http://ws.apache.org/jaxme/)
  - An implementation of JAXB
- JXM (http://jxm.sourceforge.net/)
- Jbind (http://jbind.sourceforge.net/)

Q & A

- http://ncicb.nci.nih.gov/core/caBIO